

## THE VICTORIAN HIGH PLAINS—THE ENVIRONMENT AND ITS USE

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### Introduction

The determination of the most suitable use for an area of land is a complex ecological problem. A satisfactory solution cannot be obtained by considering only those matters affecting the inter-relationships of plants and animals with the soil. When man becomes the dominating influence in the environment, aspects of human ecology assume importance, and social, economic and sometimes even political implications must be considered. But in spite of these complications, the major decisions about suitable and unsuitable forms of land-use for an area should be made according to scientific facts. The human factors should provide a basis for deciding only whether or not some degree of compromise is warranted under prevailing circumstances, and to what degree and for how long it can be permitted without sustaining serious and irreparable damage to the land.

Man's influence in an environment is directed generally toward obtaining the kind and level of production which he needs. Sometimes this objective is pursued without much thought about whether the productivity can be maintained. In many parts of Australia this attitude has resulted in damage to the land itself and a decline in productivity. Soil conservation aims to reverse or prevent this trend by determining those forms of land-use and management which will provide, for each kind of land, a level of productivity which can be maintained indefinitely. Basically, this is a matter of finding out how the original ecologically balanced array of plants and animals can be replaced by another managed system, in which man and the plants and animals he has introduced can survive together in the environment to provide both production and stability.

The degree of difficulty in determining desirable systems of land-use and management depends to a large extent on the nature of the original environment. For some favoured environments it is relatively easy; but for others, which even in the natural condition were in a precarious state of equilibrium, it is extremely difficult. It becomes even more difficult, if widespread deterioration is allowed to occur before some action is taken to amend a faulty system, because, instead of being faced with the modification of the original stable environment, the problem becomes one of initiating an ecological succession in an entirely new and much more difficult unstable environment, in order to achieve reclamation.

In dealing with a single landholder, modifications or changes in land use are not difficult to implement, once the landholder has been convinced of the need. However, on public land one is confronted with the conflicting opinions of different groups of people with respect to possible forms of land-use, their suitability for the area and their relative importance to the economy of the State. Consequently the problem is one of assessing the technical possibilities of the various suggested forms of land-use, their effects on the land itself, to what extent they are complementary or

conflicting, and which of them under the prevailing circumstances should be given priority in the public interest.

The Victorian high plains are public land in which different groups of people have an interest with respect to various kinds of land-use. For various reasons it is a difficult environment, which limits the possible range of techniques for providing stability under some of the forms of land-use for which some groups of people consider it to be suitable.

By direction of the Government, the Soil Conservation Authority is responsible for making decisions with respect to land-use on all areas in Victoria having an elevation of more than 4,000 ft above sea level. However, the administration of the areas still remains with the Departments in which the land is vested.

To exercise its responsibility properly, the Authority needs to know the nature of the environment, the particular characteristics which favour various kinds of use and production, and those which would prevent its safe use for certain purposes. From this information the Authority can determine the kinds of land-use to which the area can safely be put in the public interest, their relative importance, and the conditions under which such uses may be permitted.

At present there is insufficient basic information to provide categorical answers to all the problems. However, studies on the nature of the environment, and observations of changes under various kinds of use by man indicate trends and provide a warning of the need for most careful consideration in determining how these areas may be used safely in the public interest.

### The Characteristics of the Environment

Detailed information about various features such as geology, geomorphology, climate, hydrology, soils, flora and fauna of the high plains, has been given by other contributors to this symposium. Collectively, these features constitute the total environment, and the information given, although more than adequate, needs to be collated and summarized, to portray a picture of the environment and its important and significant characteristics with regard to potential land-use.

The high plains, as defined for the symposium, include a number of separate areas all of which are the remnants of uplifted peneplains which have been dissected to a greater or lesser extent. The individual areas do not occur at the same elevation above sea level, but they are all higher than 4,000 ft. Because they are remnants of peneplains, the topography is rolling, and the only really steep country is that adjacent to the streams dissecting the areas and on the sides of some of the residual peaks rising above the general level of the plains.

Because of their elevation above sea level, the climate of the plains is rigorous. The precipitation is high and most of it falls as snow during the winter months. Usually the plains are completely snow-covered for several months, but there are occasions when a thin snow cover melts in the late autumn or early winter and the soil and vegetation are subject to severe frost until the area receives a new blanket of snow. The temperatures are low throughout the winter, but the most severe conditions are associated with frosts, which may occur at any time of the year. This is particularly so in areas which, due to topographic conditions, are suitable for accumulating cold air drainage.

In elevated and exposed sites, especially those with a westerly aspect, strong winds provide severe climatic conditions, both in winter, when the winds are cold, and in summer, when the winds are hot and dry. The daily range of temperature is large in summer and, during the day-time, although temperatures are not particularly

high, there is considerable incident solar energy, and the evapotranspiration, especially when there are hot dry north winds, can be considerable.

Although the climate is severe on all areas above 4,000 ft, from observations it appears that differences in elevation can ameliorate or intensify the conditions to an extent which is significant with respect to the use and management of different areas, and also to the ease or difficulty with which reclamation of damaged areas can be achieved.

Under such climatic conditions, it is to be expected that the soils and vegetation will have peculiar characteristics. The soils which have been described by Costin (1955) can be conveniently considered in three broad groups: first, the lithosols, in which there has been little profile development and the soil is really physically disintegrated parent rock with some accumulated organic matter in the surface horizon; second, the widespread alpine humus soils, which occur on the gentle well-drained slopes and show some degree of profile development; and third, a range of organo-mineral and organic soils which occur in the poorly drained and permanently wet or damp areas.

The vegetation which has been described by Costin (1957b, 1959), consists of an array of species adapted to survive under the rigorous climatic and poor soil conditions. There is a growing season of only three to four months and, because freezing temperatures can occur at night throughout the year, new seedlings can survive only under the protective cover of other vegetation. The vegetation formations are analogous to those found under similar climatic conditions in other parts of the world. However, the indigenous species are not so well adapted to survive grazing as those in other countries where close-grazing animals have been a part of the environment during the period of ecological development.

Because of their elevation, the high plains constitute the snow fields of the State and provide a natural storage of winter precipitation which is slowly released during later spring and summer. A few small areas on south-easterly aspects favour the survival of snow patches, but there is no permanent snow. The occurrence and extent of snow patches, and how long they survive, depend on the particular conditions of each season.

Although the high plains constitute only small proportions of the total area of the various catchments of which they are uppermost parts, they are important hydrologically. They are the areas of highest precipitation, and have the highest water yield per unit area of any part of the catchment. On the lower forested parts of catchments, the water yield from precipitation becomes stream flow soon after rain, and the bulk of the water yield occurs during the winter, when it is not so valuable for irrigation purposes and, once storages are full, the excess is wasted. The yield from the high plains comes later, during the spring and summer, when water is being withdrawn from storages, and it is therefore a vital component of the total water yield of the catchment.

These areas are even more important as catchments for the production of hydro-electricity, because they produce water at a high elevation.

The high plains are well watered, open, rolling country, occurring in the midst of steep, inhospitable, forested areas, and give the impression of being fertile and useful. However, this is a false impression. The soils are acid and poor, the growing season is short, the climate is severe, the vegetation is not adapted to hard grazing, and great care must be exercised in the use of the country because, once it is damaged, it is difficult to reclaim. This is because there is a restricted range of species which can be used for revegetation and because the young seedlings, even those of

native species, find it difficult to survive on open, bare ground because of the effects of frosts.

This general description of the environment applies to the high plains as a region within which there are several different kinds of country. These differences are reflected in the different soil-vegetation associations which occur in certain kinds of local climatic and topographic situations, and each of the different units requires independent consideration with respect to its possible land-use.

The different units have been described by Costin (1957a, 1957b, 1959), in varying degrees of detail, but for present purposes three major units can be considered. These are woodlands, grasslands and herbfields, and the fens and bogs of the valleys, which together constitute almost the whole of the area of the high plains in Victoria.

### Land-Use on the High Plains and Its Effects

At present the high plains are used as catchments to major water supply reservoirs, catchments to hydro-electric works, for grazing, for tourist activities and for snow sports, and it has been suggested that they should also be a National Park.

Water conservation for irrigation, and also for the development of hydro-electricity, has focused attention on the importance of the high plains areas as water supply catchments. Their high elevation and the fact that they are snow-covered for part of the year makes them particularly important parts of catchments. Attention has been directed to their condition in relation to catchment efficiency, and criticism (Costin 1957a, 1958; Aust. Acad. of Sci. 1957) has been aimed not only at the effects of grazing but also at the effects of engineering works and other developments which have taken place in some parts of the high plains.

The high plains have been used for grazing for about 100 years. At first the country was used mainly for drought relief and subjected to only spasmodic grazing. However, evidence shows that during severe droughts extraordinarily large numbers of animals were crowded on to these areas and the grazing pressure was high.

At various times the areas have been grazed by horses, sheep and cattle, but for many years the only grazing has been by cattle.

The grazing value of the high plains originally was due to a variety of herbs which grow in the spaces between the snow grass tussocks. Under grazing these were quickly eaten out. When this occurred, it became the practice to burn the snow grass tussocks, to provide reasonable grazing from more palatable new growth. This had the effect of opening up the sward and left the now uninhabited bare spaces open to the frost, wind and rain. The blanket of tussock which provided insulation against frost heave was gone. The bare spaces were subject to raindrop action and to wind action. The grass tussocks were subject to blasting by soil particles blown from the inter-tussock spaces and so the grass declined and the bare spaces enlarged. Even without grazing, the revegetation of these bare areas is extremely slow and will occur only when there is sufficient top growth of the snow grass to provide an adequate protective cover against rain and wind and insulation against frost action on the soil.

The changed conditions have been more favourable to rabbits and in some places these have accentuated damage. Although grazing has caused a deterioration of the vegetative cover over large areas of the high plains, it has reached a serious state only on some of the higher and most inhospitable parts.

Excessive grazing pressure on the grassland and herbfield has to some extent

been caused by the complete loss of grazing value of some of the woodland areas as the result of fires. After fires, the snow gums regenerate by suckering and, instead of an area of grass beneath spaced individual trees, these areas become, unless grazed by sheep, an almost impenetrable scrub. Although this caused a reduction in the useful grazing area, for many years there was no reduction in stock numbers.

With the loss of vegetative cover and the increased bare space, run-off by rain-water and snow-melt was more rapid. Large areas became comparatively more arid, providing poor grazing, and cattle tended to concentrate around snow patches and in the fens and bogs during the summer. This has had serious consequences, particularly on the moss beds, which have been trampled out and desiccated. More rapid run-off has also caused some stream erosion of water courses along the valleys.

There is no doubt that the catchment characteristics have changed as the result of grazing and, in some areas, to a significant extent. However, over the whole of the high plains it is hard to estimate how significant the change has been, with respect to the efficiency of the catchment.

The construction of roads, diversion channels and dams in high country presents problems of rehabilitation of bare areas to obtain stability. Revegetation is difficult and expensive, but it is now generally recognized that it must be done.

Better access by road to these areas has encouraged more tourists, and snow sports have become an increasingly popular pastime. This has also created problems. Indiscriminate travelling with vehicles over vegetation which is sensitive to pressure and soil compaction, has left many unvegetated tracks—often straight up slopes—and these have become initial points of erosion damage. The establishment of whole villages, without proper planning for disposal of storm water or the revegetating of bare areas, has created erosion problems.

The concern about the condition of the high plains, and the criticism of the effects some forms of land-use have had in bringing about deterioration, are justified, at least with respect to some specific areas. The potential effect of the various forms of land-use is now known, because of the severe damage which has occurred in some areas and the moderate damage over broader areas which could easily deteriorate further.

The various groups of people interested in the use of the high plains for different reasons are aware of this and now agree on the need for conservation. The problem is to co-ordinate the policies of government departments and to supervise the activities of those using these areas to ensure that proper forms of land-use and the necessary reclamation works are implemented to maintain or even improve the efficiency of the area as water-supply catchments. Their importance as water-supply catchments is such that their efficiency for water production must always remain the prime consideration and all other uses should be subjugated to achieve that end.

#### Administration and Control of Land-Use

The high plains are Crown Lands and are mostly under the administration of the Lands Department, but the area around Mt Buller is administered by the Forests Commission and a small area around the Kiewa Works is administered by the State Electricity Commission.

For many years graziers have been given the right to graze some specified area or 'run' by the issue of an annual licence. The boundaries of the 'runs' as delineated on a map are meaningless, because they bear no relationship either to the terrain

or to the suitability of an area for grazing. So far as the grazier was concerned an annual lease was a right of entry to the area, and where his animals grazed was of no real consequence, so long as they did not wander too far away and make his task of mustering more difficult.

The number of animals put on each run was uncontrolled and consequently, as the grazing value of an area declined, there was an increase in grazing pressure on the better areas.

In 1939 the worst bushfires which had ever occurred in the State had taken their toll and, in the course of a Royal Commission, the practice of burning in mountain areas to improve grazing value was subject to severe criticism. A further Royal Commission on forest grazing revealed a need for better care of catchments and stricter control over graziers.

Control of grazing on the Bogong High Plains was instituted in 1945 when the departments concerned with soil conservation and lands, in conjunction with a committee of cattlemen, decided to reduce and control the number of animals, to ban the use of fire, and to determine dates of entry and departure of the cattle from the area in each season.

At the same time, some investigations (Carr and Turner 1959) were started to determine the effect on the vegetation if grazing were not practised.

In 1950 the Soil Conservation Authority under its new legislation established the Bogong High Plains Soil Conservation District Advisory Committee to replace the previously-constituted Committee.

Since then there has been a progressive tightening of the control and re-assessment of the grazing areas and their condition. The area around Mt Bogong has been closed to grazing since 1955, and in 1958 the area around Mt Hotham, Mt Loch and Mt Feathertop was also closed.

On Mt Buller the Forests Commission has exercised control on the numbers of cattle entering the areas each season, the fees for each run being determined on an agistment basis rather than a flat rate.

In other areas no organized control has yet been instituted; but in general the graziers have realized the need for more care and the numbers of cattle have declined.

The Authority has had inspections made of all the high plains areas to observe their condition (Costin 1957a). More recent inspections by Authority Officers indicate a reasonably satisfactory condition, except for some specific areas, and even some improvement of the country at the lower elevations.

A committee of the Australian Academy of Science made a thorough study of the condition of high mountain catchments, and in its report made several recommendations (Aust. Acad. of Sci. 1957). Of particular application to Victoria are, first, that the Soil Conservation Authority is the proper body to manage these catchments and, second, that it should be the aim to exclude all grazing from areas above 4,500 ft as soon as possible.

At this time the Government of Victoria had already directed that the Soil Conservation Authority should be responsible for decisions on land-use on areas above 4,500 ft.

In 1960 the Land-Use Committee of the Graziers' Association of Victoria investigated these areas and in its report it made several recommendations.

It recommended that the Authority should institute a form of control on the grazing of all areas above 4,000 ft elevation similar to that operating on the Bogong High Plains and that an agistment fee should be charged in addition to licence fees

to provide funds for conservation work and other projects for better management. The Committee also recommended continuing research to study the trend in catchment efficiency under grazed and ungrazed conditions and that the policy with regard to future grazing be reviewed in seven years. It also recommended the possible adoption of an agistment system to replace the present method of leasing.

Following this, the Government revised its earlier direction and made it clear that the Soil Conservation Authority was responsible for decisions on land-use for land above 4,000 ft.

This is a major task which will take some time to organize, but by the end of this year there will be control of grazing on the three major areas of high plains country and there is increasing collaboration with various authorities responsible for engineering works within these areas.

The present policy of the Authority is for multiple use of the catchment as far as this is possible. Areas at high elevations which have been seriously damaged are already closed to grazing, and investigations are being made into possible methods of reclamation using both native and introduced species, both with and without fertilizer, combined with a variety of surface protection agents.

#### Future Land-Use for Conservation

The major and most important use of the high plains is their capacity to store and produce water which is released to streams at an important time of the year—the late spring and summer. For this reason other forms of land-use should be permitted only if they can be practised without detriment to the areas as vital parts of catchments.

For soil and climatic reasons, agriculture is not practicable, but the high plains have some grazing value. It is true that grazing has changed the vegetation, and in some areas this has led to erosion. However, the system of grazing adopted is the most primitive which can be applied. Open range grazing without control and without any attempt to protect vulnerable areas is hardly a conclusive trial, in fact, it is amazing that, under this system which has been practised for so long, more damage has not occurred.

Throughout the State, similar problems have been faced on areas which have been very badly damaged by the systems of land-use and management used since settlement. To have condemned these areas for grazing or agricultural use on the basis of what had happened under primitive methods of land-use and management, without trying improved systems, would have been a completely negative and wrong approach.

To condemn grazing on all high plains, without trying improved systems, is also a negative approach which is not warranted at present, except in certain critical areas which occur more frequently at the higher elevations.

Although the condition of the high plains is not perfect, no authority in Victoria has yet considered that erosion is seriously damaging its installations. The threat is real, but there is still time to determine whether adequate control and an improved approach to grazing management can achieve a satisfactory condition.

Although attention has been focused on the high plains, some of the lower forested parts of catchments are not in good condition and at present constitute a greater threat than erosion on the high plains. This is particularly so in the Glenmaggie catchment.

There are several improvements in grazing management which might be investigated. The control of cattle numbers and the dates of entry and departure

in accordance with seasonal conditions have already led to an improvement on part of the Bogong High Plains. Systems of deferred grazing with the cattle under the control of a ranger throughout the whole season will not only provide seasons of rest for the country, but will also prevent stock from damaging vulnerable parts of the area. An agistment system instead of the present system of leasing runs will be fairer, easier to administer and will enable better control to be made of the stocking rate in relation to the carrying capacity of the country. The provision of watering places away from bogs has already proved successful in the Mt Buller area.

These, and other improvements will be tried before grazing is completely condemned.

Forestry on the high plains is probably not impossible, but highly unlikely as a form of land-use. Because of exposure, establishment would be difficult even for suitable species, and the growth rate would be slow. The establishment of trees in suitable locations, if it is possible, may be an advantage to catchment efficiency, because of the effect of trees in trapping and holding snow and delaying the thaw. So far, no investigations have been made of likely exotic tree species for this purpose.

Snow sports and tourist activities are becoming increasingly popular and the establishment of villages at high elevations can present problems. But this is a form of land-use which will continue and develop, and positive conservation works and the education of the people participating will be required to prevent damage.

Engineering works on high plains are always troublesome, but all constructing authorities are now aware of the need for care and for positive conservation works to reclaim exposed areas. However, it is important that these bodies should seek advice on conservation and reclamation at the planning stage and not after the works have been completed.

Finally, there is the consideration that these areas should become National Parks. Mt Buffalo is a National Park, but it is not truly representative of the high elevation country. Unfortunately areas of high elevation country, such as Mt Hotham and Mt Feathertop, which may have been suitable once, are certainly not in a suitable condition for a National Park at present.

There is not yet sufficient basic information to provide categorical answers to the land-use problems of the area.

Little is known about the possibility of introduced species and their possible effect in making grazing a less hazardous form of land-use. Although there has been hydrological research (Costin 1959, 1960) there is yet no answer to the hydrological significance of the moss beds and the bogs in the total catchment efficiency. Although it is known to be important, little has been done about increasing snow retention by artificial means. There is much to learn about techniques for the reclamation of areas denuded of vegetation whether by grazing, by engineering works, or by the tramping of people.

From observation it seems possible to have multiple use of the high plains where the elevation is below 5,000 ft, and such an objective can be pursued without great risk. For land above 5,000 ft it seems unlikely that any forms of land-use, other than water production, will be found to be safe or desirable, and the objective should be to maintain and, if possible, improve its condition as catchments.

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